Weekly HIGHLIGHTS

The PPPL Highlights for the week ending April 28, 2018, are as follows:

NSTX-U RECOVERY AND RESEARCH (J. MENARD)

Recovery:

The PPPL prototype PF coil has had its outer flag brazed to the lead. The PPPL team is preparing for Vacuum Pressure Impregnation (VPI) of the coil.

For the external prototype PF coil vendors, Sigma-Phi has completed winding the first layer of their prototype coil, Everson Tesla is preparing to install the VPI mold, and Tesla Engineering has resumed winding.

Research:

R. Lunsford (PPPL) travelled to DIII-D along with A. Diallo, E. Gilson, R. Maingi, and Z. Sun to participate in an NSTX-U/DIII-D National Campaign experiment with support from PPPL onsite staff A. Bortolon and A. Nagy. The experiment utilized the newly installed Impurity Powder Dropper (IPD) and the Impurity Granule Injector (IGI) to inject quantities of carbon, boron and lithium into ITER baseline discharges to monitor species specific impurity transport characteristics and to compare neoclassical transport differences between NSTX and DIII-D.

S. Sabbagh (Columbia University) participated in the DIII-D Program Advisory Committee meeting last week as a committee member and leader of the Burning Plasma Core sub-group sub-committee. The meeting was chaired by J. Sarff of the University of Wisconsin-Madison and was charged to examine and give advice on the new DIII-D 5-Year Plan proposal and presentations prior to the full review of the proposal in May.

Z.R. Wang has been invited by Dalian University of Technology (DUT) in China to become a visiting professor for three years. Wang will collaborate with the plasma physics theory group led by Prof. Z. Wang in DUT to work on MHD physics studies in the NSTX/NSTX-U and DIII-D tokamaks.

U.S. ITER FABRICATION (H. NEILSON)

A Reliability, Availability, Maintainability, and Inspectability (RAMI) assessment of the Low-Field-Side Reflectometer (LFSR) preliminary design has been delivered by subcontractor Bertin Technologies. The availability and reliability results were obtained from Reliability Block Diagram (RBD) simulations using Reliasoft software. Failure Modes, Effects and Criticality analyses (FMECA) were performed to summarize the most critical risks for the system. The Bertin report will be a deliverable for the LFSR

preliminary design review (PDR); the mitigation actions following from the risk analysis will guide the final design work for the system.

ADVANCED PROJECTS (H. NEILSON)

Stellarators (D. Gates):

S. Lazerson made a presentation at the Wendelstein 7-X OP1.2b Experimental Program Workshop entitled, "Progress toward a steady-state scenario." The talk reviewed the progress the W7-X team has made toward a steady-state operating scenario. A key part of this talk was identification of both critical issues to achieving a steady-state scenario and actions addressing these issues. Currently W7-X is on a clear path toward a high-performance, steady-state scenario. Fueling in hydrogen and wall conditioning were identified as high-level critical issues. Steady-state pellet injection, boronization, and an in-situ boron powder dropper have been identified as key systems that can address these issues.

N. Pablant attended the High Temperature Plasma Diagnostics (HTPD) conference, held April 15-19 in San Diego, California. A contributed poster was titled, "Validation of electron temperature profiles on W7-X as measured using a X-ray imaging crystal spectrometer." In addition, Pablant co-authored two invited papers and seven contributed papers at the conference. PPPL's XICS diagnostic was featured in several conference presentations including an invited talk by A. Langenberg of the Max Planck Institute for Plasma Physics (IPP) and contributed posters by A. Pavone (IPP) and J. Kring (Auburn University).

System Studies (C. Kessel):

C. Kessel participated in the Fusion Materials Program review at Oak Ridge National Laboratory (ORNL), examining research activities at several U.S. institutions. These programs investigate a wide range of materials for fusion energy, including fusion-relevant structural steels, ceramics such as SiC-SiC composites, tungsten and tungsten-based materials, and high-temperature superconductors. The work focuses on issues of neutron irradiation behavior, advanced manufacturing, plasma-facing applications, and compatibility with fluids. The programs include varying degrees of experimentation and modeling, with significant facilities at ORNL, Pacific Northwest National Laboratory (PNNL), and internationally accessed platforms for research. Simulations range from interpreting experiments to reduced models for various time/spatial scales phenomena to SciDAC frontier tool development. The review examined these programs in terms of their scientific and technical merit, proposed methods and approach, competency of personnel, adequacy of resources, relevance, and impact.

Weekly HIGHLIGHTS

PPPL PRINCETON PLASMA PHYSICS LABORATORY

U.S. DEPARTMENT OF ENERGY

THEORY (A. BHATTACHARJEE):

Members of the Theory department attended the International Sherwood Fusion Theory Conference, held April 23-25 in Auburn, Alabama. The following poster presentations were made: D. Brennan, "Resistive plasma-resistive wall mode stability limits in rotation and beta with two fluid layers and energetic ions;" M. Cole, "Global gyrokinetic modelling of stellarators to the last closed flux surface;" V. Duarte, "Verification of the resonance broadening quasilinear (RBQ) code;" F. Ebrahimi, "Onset and nonlinear relaxation of coherent current-carrying filaments during ELMs and vertical displacement events in tokamaks;" N. Ferraro, "Modeling tokamak disruptions with M3D-C1;" N. Gorelenkov, "A quasi-linear resonance broadened model for fast ion relaxation in the presence of Alfvénic instabilities;" R. Hager, "Verification of fluid type electromagnetic modes with a gyrokinetic-fluid hybrid model in the XGC code;" E. Hirvijoki, "A finite-dimensional Vlasov-Maxwell-Landau system for computer simulations;" I. Krebs, "Benchmarking and experimental validation of MHD simulations of vertical displacement events;" M. Li, "Modeling of disruptive instabilities with energetic particle effects, resistive wall and flow in DIII-D experiments;" and C. Smiet, "Self-organizing knots in plasma."

S. Jardin hosted a satellite meeting on April 22 for the Center for Tokamak Transient Simulation (CTTS), which is funded by SciDAC. The meeting was attended by I. Krebs, and N. Ferraro presented a talk titled, "M3D-C1 Code Development."

F. Ebrahimi attended the Sherwood Executive Committee meeting and presented the logistics for holding the conference next year, which will be held at PPPL. Per approval of the executive committee, the conference next year will be hosted by PPPL at the Westin Forrestal Village hotel.

Many members of the Theory department attended and presented talks at the Max-Planck/Princeto Center for Plasma Physics (MPPC) Workshop, April 23-26, on Princeton University's main campus. The following talks were presented by Theory Department (and affiliated) members: T. Stoltzfus-Dueck, "Intrinsic rotation mechanisms;" W. Fox, "Insights into dynamics of reconnection by comparison of scaled laboratory and space experiments;" W. Fox, "Magnetic reconnection experiments on DIII-D turbulence;" A. Hakim, "Turbulence, shocks, and stochastic heating: updates from Gkeyll gyrokinetic and Vlasov-Maxwell projects;" G. Hammett, "Initial simulations of tokamak edge turbulence with the Gkeyll discontinuous galerkin code;" M. Kunz, "Impact of kinetic Larmor-scale instabilities on waves, dynamo, and reconnection in collisionless, magnetized plasma;" D. Schaeffer, "Laboratory magnetized shock generation in laser plasmas;" M. Schneller, "Energetic-particle-induced geodesic acoustic modes and their

role in regulating micro-turbulence;" and J. TenBarge, "An electron-only reconnection study motivated by MMS observations."

COMMUNICATIONS (L. BERNARD)

Hundreds of people visited PPPL's booth at Communiversity ArtsFest 2018 in Princeton on Sunday, April 29. The booth had a variety of plasma demonstrations, information, and giveaways for the public. J.J. DeVoe organized and supervised the booth. The following people volunteered: A. Dominguez; D. Ortiz; H. Neilson; P. Bruno and her daughter, Madi; S. Hudson; D. Majeski; K. Lamb; A. Datuin; V. Finley; M. Zarnstorff; E. Starkman; and B. Kraus.

In April, PPPL hosted 12 tours with a total of 230 visitors. Tour guides were: April 2 (Girl Scouts of Central and Southern New Jersey), N. Allen and A. Brereton; April 3 (Raritan Valley Community College), J. Schwartz; April 6 (Mid-Atlantic Regional Conference for the American Institute of Chemical Engineers), R. Camp; April 6 (public tour), K. Lamb; April 11 (Villanova University), A. Dominguez; April 12 (Ramapo College Engineering Physics Club), B. Kraus; April 12 (New York University Physics Club), T. Stevenson; April 13 (Princeton University Energy Conference), C. Swanson; April 18 (Hopkins School), D. Battaglia; April 20 (public tour), C. Swanson and A. Dominguez; and April 30 (Mercer County Community College), K. Lamb.

DIRECTOR'S OFFICE (R. HAWRYLUK)

R. Hawryluk attended the Sherwood Conference on April 23 and presented a talk entitled, "What Will We Learn from ITER?"

This report is also available on the following web site:
http://www.pppl.gov/publication-type/weekly-highlights